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Traditional knowledge on plant use from Negotin Krajina (Eastern Serbia): An ethnobotanical study

Pedja Janaćković*[,1,+] Milan Gavrilović[1,$] Jasmina Savić[1,#], Petar D. Marin[1,%] & Zora Dajić Stevanović[2,@]
[1]University of Belgrade - Faculty of Biology, Studentski trg 16, 11000 Belgrade, Serbia
[2]University of Belgrade - Faculty of Agriculture, Nemanjina 6, 11080 Belgrade, Serbia
E-mail: [+]pjanackovic@bio.bg.ac.rs; [$]mgavrilovic@bio.bg.ac.rs; [#]vjsavic@sbb.rs; [%]pdmarin@bio.bg.ac.rs; [@]dajic@agrif.bg.ac.rs

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This work reports the ethnomedicinal, human nutrition, animal nutrition and usage for other purposes of indigenous plants by local population (urban and rural) of the Negotin Krajina (Eastern Serbia). The group of local inhabitants (34) were interviewed by semi-structured questionnaires and the relative frequency of citation index (RFC) was determined. There are 37 plant species recorded, belonging to 21 families, where the families Lamiaceae (28.57%), Asteraceae (23.81%) and Rosaceae (23.81%) were dominant. The *Matricaria chamomilla* L. (RFC 0.56), *Urtica dioica* L. (RFC 0.53), *Hypericum perforatum* L. (RFC 0.41), *Salvia officinalis* L. (RFC 0.29), *Plantago major* L. (RFC 0.26), *Achillea millefolilium* L. (RFC 0.26), *Calendula officinalis* L. (RFC 0.24) and *Taraxacum campylodes* G.E. Haglund (RFC 0.21) are the most commonly used medicinal plants. For all cited species, it was recorded to have medicinal use, while 19 (51.35%) of them are used in human nutrition, 8 (21.62%) in animal nutrition and 20 (54.05%) plant species have usage for other purposes. The most cited medicinal use was for treating immune (43.24%), digestive (40.54%), respiratory (27.03%), as well as the skin disorders (27.03%). Our study revealed that indigenous plants are very significant especially for primary healthcare of inhabitants of the Negotin Krajina, known as a relatively isolated, multiethnic and a traditional agricultural area.

Keywords: Ethnobotany, Negotin Krajina, Serbia, Traditional knowledge, Wild plants

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Plants and products derived from them have a long history of traditional use for treatment of numerous pathological conditions. Plants still have an important role in life nowadays, although in many parts of the world there is evident loss of traditional knowledge in use of wild medicinal and edible plants[1]. However, use of herbal remedies for the prevention and preservation of health became a growing tendency due to many benefits: accessibility, safety, efficiency with wide range of therapeutic action and low cost[2,3]. Medicinal and edible aspect of vascular flora throughout the world has been insufficiently investigated[4].

There is not much of ethnobotanical evidence for East Serbia (Balkans, southeastern Europe) and any data for Negotin Krajina, a region situated on the border between Serbia and Romania and partially Bulgaria, a typical traditional, rural and underdeveloped region of the country. Therefore, we conducted an ethnobotanical study in this part of the Serbia, focusing on wild medicinal and edible plants. The goals of our study were (1) to collect and preserve the knowledge on traditional uses of wild plants by local population; (2) to compare ethnobotanical knowledge of inhabitants with literature data, as well as to determine whether there are some differences between two major ethnic groups on use of plants.

The Negotin Krajina is geographically and generally identified with the city Negotin, located in the heart of that region (Bor District of the eastern Serbia). The population of the town and of the municipality accounts for 16.882 and 37.056 inhabitants, respectively[5]. According to the last official census in 2011, the most of the settlements in the Negotin municipality belong to the Serbian ethnic majority, who speak Serbian, a Slavic language. Vlachs, a second biggest ethnic group in the area, who still strictly adhere to cultural customs today, speak Vlach language (Daco-Romanian varieties) and Serbian language. Their traditional knowledge and culture has a lot of archaic elements and roots even from hunting-gathering way of life originating long time ago when their first settlements were established here. Religion and rituals are specific as Serbian.

*Corresponding author

They also celebrate family saints ("*slava"*) which is in accordance with Serbian Orthodox Church. The value of the Negotinska Krajina lies in its cultural differences, whose preservation contributes to the world culture[6]. In all villages, youth were in the minority, because of the migration to the closest town, as well as to the capital city and abroad (mainly to western European countries), which is a growing trend in the last decades[7,8]. Therefore, the area has a low population density and is mainly inhabited by the elderly people. This could impact in losing valuable ethnobotanical knowledge regarding native medicinal and edible plants and their way of use.

Methodology

The present survey is focused on Negotin city and surroundings villages, including: Štubik, Prahovo, Bukovče and Radujevac (Fig. 1), primarily sustained by agriculture, but also supported by the family members, the guest workers in the countries of the western Europe. The research was conducted during May–July 2016. The investigated spots are located at different elevations (28-199 m a.s.l.). The group of local inhabitants (34) was interviewed by semi-structured questionnaires. No special selection criteria were carried out in the choice of the informants. The purpose, methodology and nature of the research were explained before starting the interviews and informed consent was obtained from all informants. The most of respondents belong to the Serbian nationality, except 2 men from Prahovo, 4 men from Bukovče and 2 from Radujevac, which were of Vlach nationality and represent 24% of total informants.

Through interviews with informants, information was collected on the local names, methods of harvesting and storing plant materials, plant parts and their uses and methods of preparing herbals for usage in medical, human and animal nutrition, veterinary and in other purposes.

Fig. 1 — Location of the study area

The plant materials were authenticated by the first author of the present paper, following professional literature for determination[9-11]. Additional local names are provided upon referent literature sources[12]. Voucher specimens were deposited in the Herbarium of the University of Belgrade - Faculty of Biology, Institute of Botany and Botanical Garden "Jevremovac" (BEOU).

In this survey, we considered wild flora, with exception of four plant species which secondary had become wild (*Calendula officinalis* L., *Lavandula angustifolia* Mill., *Origanum majorana* L. and *Silybum marianum* (L.) Gaertn.). All statements were recorded in the field notebook.

Data analysis

All used plants cited by respondents have been taken into account, even when mentioned just once. Each cited plant was compared with a fresh specimen or with a picture from referent literature to establish different local names of the plant species. The relative frequency of citation index (RFC) was calculated for each mentioned plant species[13].

Results and Discussion

Informants

A total of 34 informants, both gender and of different age (the youngest was 21 and the oldest was 88) were interviewed. It was noted that traditional ethnobotanical knowledge of these people are based on traditional practical skills of their parents and grandparents. There were no differences between men and women in possessing traditional knowledge regarding wild plants. Also, there were no differences among informants in relation to age. Regarding nationality we found that respondents of Serbian nationality (26) provided 112 statements (77.24%), while 8 respondents of Vlach nationality provided 33 statements (22.76%) out of 145.

Quantitative Ethnobotanical Analysis

The results of the survey are presented in Table 1 where plants are arranged in the alphabetical order. In this work, 37 wild plant species cited by respondents have been recorded. The most cited were the following species: *Matricaria chamomilla* L. (RFC 0.56), *Urtica dioica* L. (RFC 0.53) and *Hypericum*

Table 1 — List of wild plants from the Negotin Krajina used in traditional medicine, human and animal nutrition and for other purposes, reported by informants. *RFC - relative frequency of citation index

Plant name and Voucher No	Family	Serbian folk name	Vlach folk name	RFC*	Part of the plant used in medicinal purposes	Type of preparation	Medicinal purposes	Human nutrition	Animal nutruition	Other purposes
Achillea millefolium L. (17357)	Asteraceae	hajdučka trava		0.26	shoots	infusion	antibacterial effect, stomach problems, peptic ulcer, menstrual problems, wounds			
Agrimonia eupatoria L. (17358)	Rosaceae	petrovac		0.03	shoots	infusion, balm	peptic ulcer, against diarrhea, hepatitis			
Althaea officinalis L. (17359)	Malvaceae	beli slez		0.12	roots	cold maceration	help secretion from the respiratory organs		shoots	
Anethum graveolens L. (17360)	Apiaceae	mirođija		0.03	leaves	fresh	better appetite, against vomiting and insomnia	leaves		
Arctostaphylos uva-ursi (L.) Spreng. (17361)	Ericaceae	uvin čaj		0.09	leaves	infusion	elimination of excess fluid and against inflammation of the bladder and urinary tract			
Betula pendula Roth (17362)	Betulaceae	breza		0.03	leaves, twigs, buds	fresh, infusion, juice	immune system strengthening	twigs, leaf buds and pith		
Calendula officinalis L. (17363)	Asteraceae	neven		0.24	flowers, leaves	fresh, infusion	antiseptic, antibacterial	fresh young leaves		flowers for skin care creams, shampoos and other cosmetic products
Castanea sativa Mill. (17364)	Fagaceae	pitomi kesten		0.03	flowers, fruits	fresh, oil extract, balm, cream	varicose veins, strengthening immunity, hair care and skin care	fruits		creams and oils for skin and hair care, firewood, furniture production
Chelidonium majus L. (17365)	Papaveraceae	rusa		0.03	shoots	infusion	treatment of skin cancer (melanoma), hepatitis			
Cornus mas L. (17366)	Cornaceae	dren		0.12	fruits, bark	infusion, juice	digestive system disorders	fruits for preparing jam, *slatko* (Serbian delicacy), and *rakija* - homemade alcoholic drink		
Crataegus laevigata (Poir.) DC. (17367)	Rosaceae	crveni glog		0.03	leaves, flowers, fruits	infusion	strengthening of the heart muscles and blood vessels			
Fragaria vesca L. (17368)	Rosaceae	jagoda		0.03	shoots	infusion, juice	against rheumatism, immune system strengthening, digestive	fruits for preparing jam		flowers are used to make the cream for skin care

(*Contd*.)

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Plant name and Voucher No	Family	Serbian folk name	Vlach folk name	RFC*	Part of the plant used in medicinal purposes	Type of preparation	Medicinal purposes	Human nutrition	Animal nutruition	Other purposes
Glechoma hederacea L. (17369)	Lamiaceae	dobričica		0.03	shoots	infusion	immune system strengthening, antibacterial	mixed with honey		shoots is given to horses against intestinal parasites
Hedera helix L. (17370)	Araliaceae	bršljan		0.12	leaves	infusion, syrup	against cough, skin diseases (eczema), wounds			ornamental
Helleborus odorus Waldst. & Kit. ex Willd. (17371)	Ranunculaceae	kukurek		0.03	stem veins	infusion	against pain		roots	used against fever and pain of sick animals
Hypericum perforatum L. (17372)	Hypericaceae	kantarion	sntuare	0.41	shoots	infusion, oil extract	stomach problems (ulcer, heartburn), wounds, burns, prevention of venereal diseases	shoots	shoots	animal skin protection and against liver fluke
Juglans regia L. (17373)	Juglandaceae	orah		0.09	fruits	fresh	reduce cholesterol in blood	fresh fruits, *rakija* - homemade alcoholic drink		coloring textile and dyeing hairs
Laserpitium siler L. (17374)	Apiaceae	raskovnik		0.12	roots	fresh	antidote for snake venom, cataracts			root is used for magical beliefs
Lavandula angustifolia Mill. (17375)	Lamiaceae	lavanda		0.03	flowers, twigs	fresh, infusion	against insomnia, sedative		shoots	flowers are used for cosmetic products - shampoos and skin care creams, against moth
Matricaria chamomilla L. (17376)	Asteraceae	kamilica	ojkimculuj	0.56	flowers, leaves	infusion	digestive system disorders, vaginal disorders, eye care			flowers are used to make the cream for skin care, and as aroma for shampoos
Morus nigra L. (17377)	Moraceae	crni dud		0.03	flowers, leaves	infusion	against obesity and diabetes	fruits		*rakija* - homemade alcoholic drink
Origanum majorana L. (17378)	Lamiaceae	majoran		0.03	shoots	fresh, infusion	against sore throats, pneumonia, sedative			
Origanum vulgare L. (17379)	Lamiaceae	vranilova trava		0.03	shoots	infusion	antibacterial	leaves		
Pinus nigra J.F.Arnold (17380)	Pinaceae	crni bor		0.03	leaves	infusion	against inflammation of respiratory organs	young shoots		timber, firewood
Pinus sylvestris L. (17381)	Pinaceae	beli bor		0.03	leaves	infusion	against cold, cough and pneumonia	young shoots, honey		the resin is used to make oil for the skin, timber, firewood

(*Contd*.)

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Plant name and Voucher No	Family	Serbian folk name	Vlach folk name	RFC*	Part of the plant used in medicinal purposes	Type of preparation	Medicinal purposes	Human nutrition	Animal nutruition	Other purposes
Plantago major L. (17382)	Plantaginaceae	ženska bokvica		0.26	leaves	infusion, syrup, balm	against pneumonia, cough and hemorrhoids		leaves	mixed with lard and goose fat
Primula vulgaris Huds. (17383)	Primulaceae	jagorčevina		0.03	flowers, roots	infusion	against pneumonia, strengthening of the heart, sedative	leaves		
Prunus avium (L.) L. (17384)	Rosaceae	divlja trešnja		0.03	twigs, fruits, bark	infusion, juice	against diarrhea, diuretic, sore throat	fruits		flowers are used for cosmetic products - shampoos and skin care creams
Quercus petraea (Matt.) Liebl. (17385)	Fagaceae	hrast kitnjak		0.03	bark	infusion	against pneumonia, diabetes, immune system strengthening		fruits	firewood, timber
Robinia pseudoacacia L. (17386)	Fabaceae	bagrem	Salkim	0.03	flowers	infusion	against cold and cough	flowers		
Rosa canina L. (17387)	Rosaceae	šipak		0.03	fruits	infusion, juice	stomach problems, immune system strengthening, elimination of excess fluid and against inflammation of the urinary tract	fruits are used for preparing jam		
Salvia officinalis L. (17388)	Lamiaceae	žalfija		0.30	leaves	infusion	antiseptic for flushing throat, gums and teeth during inflammation			
Silybum marianum (L.) Gaertn. (17389)	Asteraceae	mlečni čkalj		0.03	seeds	infusion	liver cleansing, digestive system disorders			
Taraxacum campylodes G.E.Haglund (17390)	Asteraceae	maslačak		0.21	shoots, leaves, flowers	fresh	against hemorrhoids, immune system strengthening, latex for removing warts	leaves	whole plant	mixed with lard and goose fat
Thymus vulgaris L. (17391)	Lamiaceae	majčina dušica		0.06	flowers, leaves	infusion	digestive system disorders, antibacterial	leaves, flowers		
Tilia tomentosa Moench (17392)	Malvaceae	srebrna lipa	ćiu	0.06	flowers, leaves	infusion	against pneumonia, sore throat and cold, calm sleep and sedative			flowers are used for cosmetic products - shampoos and skin care creams
Urtica dioica L. (17393)	Urticaceae	kopriva	urzk	0.53	shoots	infusion	against pneumonia, immune system strengthening, strengthening the hair roots	shoots, mixed with honey	shoots	flowers are used for cosmetic products - shampoos and skin care creams

perforatum L. (RFC 0.41). Of the total of 21 families, the most dominant were representatives of the Lamiaceae (28.57%), Asteraceae (23.81%) and Rosaceae (23.81%). Wild plants usage records are seen in Fig. 2.

Plants used for medicinal purposes

There is a wide specter of diseases which could be cured with different plant species. Usage of wild medicinal plants in the treatment of various diseases of different human organs systems is shown in Fig. 3. In other studies conducted in Serbia most frequently reported medicinal uses were for treating gastrointestinal (50%) and skin injures and problems (25.60%)[7], gastrointestinal (33.06%) and respiratory diseases (29.56%)[14]. Different parts of the plants are used for different kind of diseases which is shown in Fig. 4. Leaves, as most used parts of the plants are also documented in some studies conducted in Serbia[14,15], while shoots are the most used documented in other studies[7,8].

The dominant types of preparation of the herbal remedies are shown in Fig. 5. Infusion as dominant type of preparation is in accordance with other studies in Serbia[7,8, 14-16]. Infusion, extract most often obtained by pouring boiling water over dry or fresh different parts of plants, called "spravljanje čaja" (in Serbian), is the most common form of preparation in households for healing different type of diseases and in everyday life for pleasure[16]. Internal usage is primarily for treatment of diseases of the stomach, liver, kidney, lung, strengthening the body and nervous system. External usage is mostly for treatment of musculoskeletal system (rheumatism) and various skin injuries (burns, wounds). For some of the plants were noted that are often used for making the spirit, known as *rakija* (in Serbian), a traditional Serbian alcoholic brandy, obtained by fruit fermentation. It can be used as aperitif, to increase the appetite, help in digestive problems, for rheumatism and varicose veins, skin wounds, and decreasing cholesterol in blood. So far, some herbal spirits from the Balkan region have been evaluated for its way of production and the quality[17], chemical composition[18], antioxidant activity[19] and sensory characteristics[20,21]. Moreover, for obtaining the plant oil extracts, several

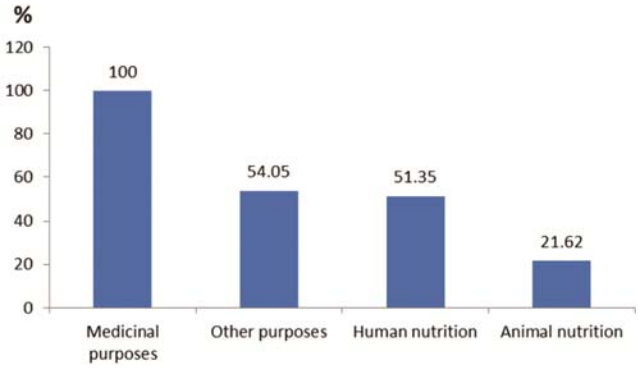

Fig. 2 — Wild plants usage records. The number above each bar presents percentage

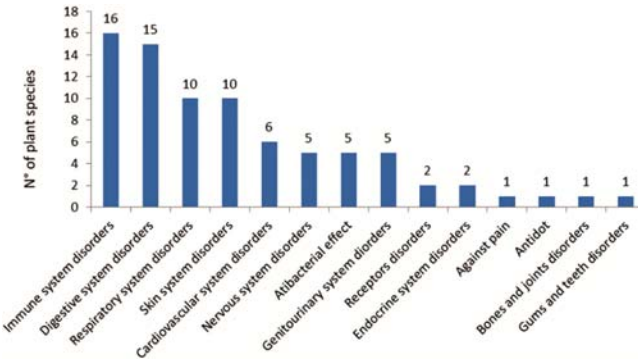

Fig. 3 — Usage of wild medicinal plants in the treatment of various diseases. The number above each bar indicates the total number of species

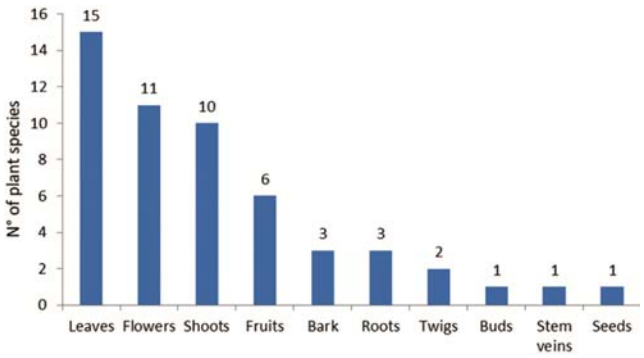

Fig. 4 — Parts of the plants use in medicinal purposes. The number above each bar indicates total number of the species

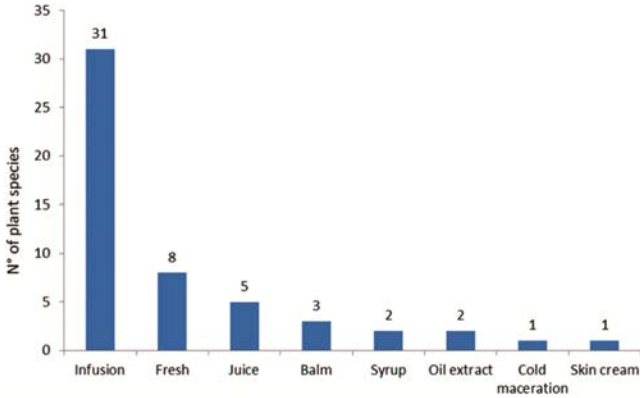

Fig. 5 — Preparation types of the herbal remedies. The number above each bar indicates the total number of species

herbs are used, usually by some longer, up to 40 days maceration in the oil of different origin. Informants noted that *H. perforatum* should not be mixed in any form with other plants, nor should it be use *per os* if antidepressants or contraceptive pills are used because it diminishes their effect. The plant is very appreciated in Serbian folk and used for range of healing and prevention purposes[7,16], out of the most frequent are recorded here. Also, plant parts are mixed with honey for the treatment of bacterial infections of the throat and nose and for strengthening immunity and against pneumonia.

Some plants are mixed with lard and goose fat used against hemorrhoids, wounds and varicose veins. We also documented some plants which are combining in the tea plant mixture. *U. dioica* and *C. officinalis* which are mixed to prevent the cold, pneumonia and influenza. Furthermore, fruits of *Rosa canina* L. and *Arctostaphylos uva-ursi* (L.) Spreng. are used for the elimination as diuretics and against inflammation of the urinary tract, which was already recorded for study area[7]. A mixture of *Tilia tomentosa* Moench, *Achillea millefolium* L., *U. dioica* and *Salvia officinalis* L. are used to strengthen immunity and to cleanse the body from toxins.

Uncommon medicinal plants or usage

It was recorded some unusual medicinal usage of two plants: *Helleborus odorus* Waldst. & Kit. ex Willd. and *Laserpitium siler* L. For *H. odorus* it is mentioned earlier that fruits could treat tooth-ache[22,23], but informants mentioned that infusion of stem veins is used for treatment of a painful place. For *L. siler*, a very known plant in Balkans, with numerous magical properties attributed to it[24], there is no reports so far on medicinal usage, such as antidote for snake venom and for treating the cataract. This usage for *L. siler* provided to us by informants of the Vlach ethnic group only, and that finding was in fact the only one differing from responses of informants of the Serbian nationality concerning traditional use of plants in the study region. In eastern Serbia, *L. siler* is considered to be the most powerful magical plant that protects households and its members from any evil, reveals and removes sorceries, brings success in work, happiness in love, etc.[25]. These plants, perhaps, could be worthwhile to further investigate from phytochemical and pharmacological aspects, in addition to only few reports on some Balkan endemic species of this genus[26].

Plants used in human and animal nutrition and other purposes

Among 37 recorded species, 19 (51.35%) are used in human nutrition (Table 1). In Serbia, fruits are widely used in very different ways (fresh fruits, compote, fruit tea, juices and syrups, *slatko*, jam, etc.)[25]. Some popular wild berries (blueberry, strawberry, raspberry, etc.), as well as rosehip, dogberry, and some others, which are often used as traditional food and medicine[7,27]. Informants also provided to us a couple of recipes how to prepare meals using wild plants mentioned above. Among 38 recorded species, eight (21.62%) are used in domestic animal nutrition (Table 1). There are many wild plants adapted to local, harsh conditions that have enormous potential as a livestock feed. Wild plants (20 documented) are also used for other purposes (54.05%) which could serve in everyday life (Table 1).

Comparison with other investigations conducted in Serbia

We carried out ethnobotanical comparison between our results and ethnobotanical data conducted in other investigated area of Serbia: Central Serbia[7], South-Western Serbia[14,15] and Eastern Serbia[8] (Table 2). There are eight species (21.62%) reported in our study which were not mentioned in other

Table 2 — Ethnobotanical comparison between our results and ethnobotanical data conducted in other investigated areas of Serbia

Area	Year(s) when the studies conducted	No of wild plant taxa	No of wild medicinal taxa	No of wild taxa used in human nutrition	No of wild taxa used in animal nutrition	No of wild taxa used in other purposes	References
Central Serbia	2002-2005	83	83	25	/	18	Jarić et al. (2007)
South-Western serbia	2010	40	40	5	/	8	Pieroni et al. (2011)
South-Western Serbia	2011	69	69	3	/	/	Šavikin et al. (2013)
Eastern Serbia	2011-2012	45	45	/	/	/	Zlatković et al. (2014)
Eastern Serbia	2016	38	38	19	8	20	recent study

ethnobotanical studies in Serbia. These species are: *Anethum graveolens* L., *Crataegus laevigata* (Poir.) DC., *L. siler*, *O. majorana*, *Pinus nigra* J.F.Arnold, *Quercus petraea* (Matt.) Liebl., *S. marianum* and *T. tomentosa*.

Conclusion

Our study represents a contribution to the preservation of knowledge and way of use of wild plants by local population on the Negotin city and surrounding villages (East Serbia). Also, we showed that indigenous plants are very significant especially for primary healthcare of inhabitants of the Negotin Krajina, known as a relatively isolated, multiethnic and a traditional agricultural area. Ethnobotanical investigations are crucial initial step for local rural development based on eco-tourism, small-scale trade of indigenous medicinal and food plants, eco-museums, as well as community-based bio-conservation strategies.

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